WHAT WE CLAIM IS:

1.   A projection viewing system, comprising:

at least a first display device and a second display device,

5   at least a first projection optical system and a second projection optical system,

a diffusing plate, and

an eyepiece optical system, wherein:

said first projection optical system projects an

10   image appearing on said first display device in a first direction and said second projection optical system projects an image appearing on said second display device in a direction different from said first direction,

said diffusing plate is located near to images

15   projected through said first and second projection optical systems, and

said eyepiece optical system projects exit pupils of said first and second projection optical systems onto an viewer side.

20   2.   The projection viewing system according to claim 1, wherein said diffusing plate has an angle of diffusion of up to 20° at full width half maximum.

3.   The projection viewing system according to claim 1, wherein said diffusing plate has an angle of

25   diffusion of up to 40° at a 1/10 full width.

4.   The projection viewing system according to claim 1, wherein said diffusing plate has a surface

roughness that satisfies the following condition:

$$5 < (Sm/Ra) < 1,000 \qquad \text{... (1)}$$

where Sm is a mean pit-to-projection space of a diffusing
surface according to JIS B0601 (μm), and Ra is a center-
line mean roughness of said diffusing surface (μm).

5.   The projection viewing system according to
claim 4, which further satisfies the following conditions:
for a single transmission type diffusing plate,

$$5 < (Sm/Ra) \times (Ep/400) < 70 \qquad \text{... (2)}$$

for a double-transmission type diffusing plate,

$$10 < (Sm/Ra) \times (Ep/400) < 80 \qquad \text{... (3)}$$

for a front-surface reflection type diffusing plate,

$$50 < (Sm/Ra) \times (Ep/400) < 200 \qquad \text{... (4)}$$

for a back-surface reflection type diffusing plate,

$$80 < (Sm/Ra) \times (Ep/400) < 250 \qquad \text{... (5)}$$

where Sm is a mean pit-to-projection space of a diffusing
surface of said diffusing plate according to JIS B0601
(μm), Ra is a center-line mean roughness of said diffusing
surface (μm), and EP is a distance from said diffusing
surface to a position of a viewer's eye (mm).

6.   The projection viewing system according to
claim 4, which further satisfies the following condition:

$$Sm < 200 \ \mu m \qquad \text{... (9)}$$

7.   The projection viewing system according to
claim 1, wherein said eyepiece optical system comprises a
Fresnel lens.

8.   The projection viewing system according to

claim 1, wherein said eyepiece optical system comprises a reflecting surface.

9. The projection viewing system according to claim 1, wherein said eyepiece optical system comprises a Fresnel reflecting mirror.

10. The projection viewing system according to claim 1, wherein said eyepiece optical system comprises a Fresnel back-surface reflecting mirror.

11. The projection viewing system according to claim 1, wherein said diffusing surface is provided on at least one surface of said eyepiece optical system.

12. The projection viewing system according to claim 1, wherein said diffusing plate comprises a transmission type hologram, and said eyepiece optical system comprises a concave mirror.

13. The projection viewing system according to claim 12, wherein said concave mirror comprises a Fresnel concave reflecting mirror.

14. The projection viewing system according to claim 12, wherein light rays from said projection optical systems to an exit pupil of said projection viewing system transmits said diffusing plate twice, wherein said projection optical systems and said diffusing plate are located such that an angle at which said light rays transmit said diffusing plate at a first time is different from an angle at which said light rays transmit said diffusing plate at a second time.

15. The projection viewing system according to

claim 12, wherein said concave mirror is located such that axial chief rays from said projection optical systems are obliquely incident thereon.

16.   The projection viewing system according to claim 12, wherein zero-order light leaving said diffusing plate is kept from being incident on an exit pupil of said projection viewing system.

17.   The projection viewing system according to claim 12, wherein zero-order light leaving said diffusing plate propagates toward an exit pupil position of said projection viewing system, and is incident on a portion of said exit pupil spaced away from a center of said exit pupil at a distance of at least 1/2 of the diameter of said exit pupil.

18.   The projection viewing system according to claim 12, wherein said diffusing plate has a flexion action by diffraction.

19.   The projection viewing system according to claim 18, which further satisfies the following condition:

$$\gamma > 1° \qquad … (7)$$

where γ is a d-line angle of flexion of an optical axis by said diffusing plate.

20.   The projection viewing system according to claim 19, which further satisfies the following condition:

$$\gamma < 45° \qquad … (8)$$

where γ is the d-line angle of flexion of an optical axis by said diffusing plate.

21. The projection viewing system according to claim 12, wherein a difference in an angle of diffraction of an optical axis by said diffusing plate between 700 nm wavelength light and 400 nm wavelength light is up to 18°.

22. The projection viewing system according to claim 12, wherein, at a position of the exit pupil of said projection viewing system, a difference in a position of incidence between a 700 nm wavelength optical axis and a 400 nm wavelength optical axis is up to 1/2 of a diameter of said exit pupil.

23. The projection viewing system according to claim 12, which further satisfies the following condition:

$$0° < \beta < 45° \qquad \dots (9)$$

where β is an angle of incidence of a d-line optical axis on said concave mirror.

24. The projection viewing system according to claim 12, which further satisfies the following condition:

$$0.01 < \gamma/\beta < 1,000 \qquad \dots (10)$$

where γ is an angle of flexion of a d-line optical axis by said diffusing plate, and β is an angle of incidence of a d-line optical axis on said concave mirror.

25. The projection viewing system according to claim 1, wherein said projection optical systems are located such that either one of optical axes thereof crosses said eyepiece optical system, and an angle that a perpendicular to said eyepiece optical system at a point of intersection subtends said optical axis is 10° or

greater.

26.   The projection viewing system according to claim 1, wherein at least one of said projection optical systems is made up of a decentered prism comprising at least one decentered prism formed of a medium having a refractive index (n) of greater than 1 (n>1), wherein:

said decentered prism comprises:

an entrance surface through which a light beam scanned by said scanning means enters said prism,

at least one reflecting surface for reflection of said light beam within said prism, and

an exit surface through which a light beam leaves said prism, wherein said at least one reflecting surface has a curved surface shape that is rotationally asymmetric enough to make correction for aberrations occurring due to decentration.

27.   The projection viewing system according to claim 26, wherein said reflecting surface comprises a first reflecting surface and a second reflecting surface,

said first reflecting surface providing reflection within said prism of a light beam entered from said entrance surface in said prism, and

said second reflecting surface providing reflection within said prism of a light beam reflected at said first reflecting surface, and

a light beam from said entrance surface toward said first reflecting surface and a light beam from said second reflecting surface toward said exit surface cross each

other within said prism.

28. The projection viewing system according to claim 26, wherein said reflecting surface comprises a first reflecting surface and a second reflecting surface,

said first reflecting surface providing reflection within said prism of a light beam entered from said entrance surface in said prism, and

said second reflecting surface providing reflection within said prism of a light beam reflected at said first reflecting surface, and

said entrance surface and said second reflecting surface are defined by one single surface.

29. The projection viewing system according to claim 1, wherein images appearing on said display devices are distorted upon display in such a way as to compensate for an image distortion due to said projection optical systems.

30. The projection viewing system according to claim 26, wherein:

said decentered prism optical system is configured in a shape symmetrical with respect to plane,

said projection optical systems are located such that either one of optical axes thereof crosses said eyepiece optical system, and

an angle that a perpendicular to said eyepiece optical system at a point of intersection subtends said optical axis is 10° or greater.

31.   The projection optical system according to claim 26, wherein:

said decentered prism optical system is configured in a shape symmetrical with respect to plane,

said scanning means is located on an object plane of said decentered prism optical system,

a scanning area formed by said scanning means is projected near to said eyepiece optical system, and

said scanning means is located such that a longitudinal or lateral direction of said scanning area projected is substantially in line with a longitudinal or lateral direction of said eyepiece optical system.

32.   The projection viewing system according to claim 1, wherein said projection optical system has a function of making correction for a distortion of a tilted image.

33.   The projection viewing system according to claim 1, wherein said light source is an LED or LD.